

# Hides and Leather Research Program 4578

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Many of you are familiar with the Hides and Leather Research Laboratory of the Department of Agriculture. For those of you who perhaps are not, just a few brief words about it. The Department of Agriculture has had a hides and leather research program dating back to the early part of this century. For the last 40 years it has been at the Eastern Regional Research Center (ERRC) in Philadelphia. It is now a part of Agricultural Research of the Science and Education Administration, the agency that used to be the Agricultural Research Service. The hides and leather research is conducted in two laboratories at the Center. One of these, which is totally dedicated to this research, is the Hides and Leather Laboratory. In addition, the Engineering and Development Laboratory at the Center has two leather-related projects as part of its program. The combined manpower effort on this research is carried by about 30 people, including scientists, engineers, and technicians. We have an ongoing laboratory-scale program; but, in addition, we have a pilot plant with the capability of carrying 10 to 12 sides or their equivalent at a time through to finished leather. With this capability we can fully evaluate laboratory developments on a meaningful scale. Being located at the ERRC, which has a total staff of about 300 and five additional laboratories, gives us the ability to interact with scientists from many disciplines as well as access to rather elaborate and sophisticated scientific instrumentation, which a leather laboratory of our size itself would not be able to have. Other laboratories at the Center include one in animal fat research and one in meat research. Obviously, these have direct relationship to the work in which we are involved and we maintain close contact.

Our hides and leather research program has as one of its primary goals, if not its most important goal, that of optimizing the utiliza-

tion of cattlehides. However, it includes all hides and skins that are byproducts of the red meat industry and used primarily for leather manufacture. Other goals include improvements in hide quality, handling, and grading. Obviously, the hide, this major byproduct of the red meat industry and the major leathermaking raw material in this country, occupies the central place in our research plans, as it does in your business.

For the tanning industry, the hide has always been of utmost importance from both a quality standpoint and an economic standpoint. Even when cured cattlehides were at 30 cents a pound, they represented about 50 percent of the cost of making the leather. I estimated that last spring, with hide prices at 90 cents per pound and an increase in other manufacturing costs resulting from the normal inflationary increases, the cost of the hide amounted to about 75 percent of the leather manufacturing cost.

Despite these facts concerning the hide, it has been surprising to us, and at the same time somewhat disappointing, that more attention has not been paid to obtaining the optimum return from it, as well as eliminating the large amount of waste that takes place. Not only have the normal practices been wasteful of the raw material, they have created a large waste disposal problem.

These concerns of ours have caused us to implement a rather extensive research program directed at optimizing the processes by which the hide is converted into a blue product, utilizing as much of the hide material as is possible and eliminating, or significantly reducing waste. This research program consists of projects in my laboratory, in our Engineering and Development Laboratory, at Oklahoma State University, at Syracuse University, and two studies being carried out under contract with

private companies.

In the project at the heart of this program, we are thoroughly studying and analyzing the materials, including the hide, that go into and come out of each unit process used for converting the hide into blue stock. By unit process, I mean either liming, de-hairing, pickling, tanning, wringing, fleshing, or splitting; and we are evaluating as many variations to each of these unit processes as we can find. Process variations include those in common use as well as those proposed in the literature. The properties of the hide as it comes out of each of these unit processes are being thoroughly studied. These include both chemical and physical properties. We have both drums and a mixer in which to carry out this work, as well as the necessary mechanical equipment. We are including in this study both recovery and reuse of chemicals and recycling of process streams. The amount of data being accumulated is voluminous. We have in-house statisticians and computer specialists working with us in handling and analyzing these data. In addition, we have a group developing a computer model of these operations for us, but more about that in just a minute.

As a further part of this program, a group of engineers, both chemical and mechanical, in our Engineering and Development Laboratory is exploring an automated mechanical beaming operation. In the process under study, the hides will be mounted on a conveyor system for soaking, chemical hair-loosening, mechanical dehairing, refleshing, and splitting. The split parts of the hide would then go into a conventional reliming and bate-pickletan. The machinery and process tanks for this are being set up now at the Center and should be operational next year. Laboratory studies indicate a high likelihood of success for this automated me-

chanical beaming operation and it, as a sequence of unit processes, will be evaluated as part of the overall program.

We have completed one large project in-house on treatment of tannery waste. We have two ongoing in-house projects in that area right now in addition to an extramural project at Syracuse University. In these projects we are now looking at different untried ways of handling primarily beamhouse waste to determine which is the most efficient process to use.

The project being carried out for us at Oklahoma State University includes the development of a computer model of the tanning process. This computer model treats all of the unit processes, about which I spoke a few minutes ago, as separate entities but permits them to be used and manipulated both individually and collectively in sequences that would represent a bluing process. Different waste treatment steps are also treated as unit processes and can be used with the others. The hide represents a continuous stream as it flows from process to process and other materials, including chemicals, water, manpower, and energy, represent input streams flowing into each process. The hide, as it has been changed by the process, is considered an output stream along with exhausted floats and byproducts. These output streams can be assigned costs for disposal or value, or fed into other unit processes for treatment. The model will evaluate combinations of unit processes in terms of efficiencies and cost and product properties. Using this program, we will be able to manipulate and compare data from numerous unit processes in various combinations with different waste stream methodologies and values as-

signed to byproducts.

The remainder of the work in this program has to do with byproduct utilization. This work includes studies of non-leather uses of hide collagen as well as uses for byproducts from partially processing the hides. A part of the work on food uses of the collagen obtained from limed hides is being carried out at Oklahoma State University. Another study, being done for us under contract, is designed to determine the number and size of alternative uses, or potential uses, for limed hide collagen. Still a further study under contract is designed to determine various uses for chromium-containing solid wastes from the tanning process, including hide waste and the potential value and size of markets for these products. This information will permit us to put estimates into the computer model on the value of various byproducts from the tanning processes.

As I indicated at the outset, our primary objective is to determine the optimum utilization of hide material. With all of the information available to us, we shall attempt to determine when, where, and how in the processing scheme trimming and splitting should be performed.

It would seem that the earlier in processing that parts of the hide are removed for other uses the better from two standpoints. First, less effort and chemicals are expended in processing and, second, the less opportunity there is for the hide material to become contaminated with chemicals that might limit its use. Some of the uses under consideration are in the food, feed, and health care areas, where freedom from toxic or potentially toxic chemicals is a necessity.

Several other complementary programs are currently in prelim-

inary stages of development in our laboratories.

First, we believe that, given the current sophistication of electronic testing and data collection and manipulation systems, a rapid and efficient hide grading and accounting system could be developed. It is probable that the latter part of this is already being practiced by some of you. The grading system should be capable of determining very rapidly and accurately the amount (both area and thickness) of leathermaking raw material in a cured or uncured hide. It might also determine the adequacy of the cure. We realize that adoption of such a system could require a change in the way in which hides are marketed; however, the efficiencies of such a system, the increased value of the hide, and the development of other uses for hide material could make this desirable.

Second, and very briefly, we are applying the sophisticated techniques for measuring the physical mechanical properties of man-made polymeric substances to leather and various preleather products in an attempt to develop more meaningful correlations between composition and properties, as well as between what are described as "comfort factors" and physical properties and composition.

Finally, we are now turning our attention to an area we refer to as new technology development. The research described up to this point I would categorize as technology improvement. We feel the need to direct a part of our program toward the investigation of completely new ways of converting a hide in the future into useful products such as shoes and garments — ways that do not suffer from the problems of today's technology.

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